

REMARKS

By the present amendment and response, independent claims 1 and 10 have been amended to overcome the Examiner's objections and claims 6 and 14 have been canceled. Thus, claims 1-5, 7-13, and 15-18 are pending in the present application. Reconsideration and allowance of pending claims 1-5, 7-13, and 15-18 in view of the following remarks are requested.

The Examiner has rejected claims 10 and 16 under 35 USC §102(b) as being anticipated by U.S. patent number 3,862,017 to Tsunemitsu et al. ("Tsunemitsu"). For the reasons discussed below, Applicant respectfully submits that the present invention, as defined by amended independent claim 10, is patentably distinguishable over Tsunemitsu.

The present invention, as defined by amended independent claim 10, teaches, among other things, "a dielectric cap layer patterned on said metal resistor" and "a second intermetallic dielectric layer formed over said dielectric cap layer and said metal resistor." As disclosed in the present application, the present invention achieves a metal resistor that can be advantageously added to a standard aluminum backend process used in IC chip fabrication without impacting or disturbing the aluminum backend process flow. For example, a standard two-step dielectric deposition process can accommodate the patterning of the present invention's metal resistor on a first intermetallic dielectric layer followed by depositing a second intermetallic dielectric layer over the metal resistor. Also, the invention's novel scheme of accommodating the standard two-step dielectric deposition to integrate the invention's metal resistor between two interconnect metal

layers does not significantly increase via etch depth, and thus advantageously results in a simplified via etch process.

Additionally, as disclosed in the present application, by forming a dielectric cap layer over a resistor metal layer prior to formation of a metal resistor, the dielectric cap layer can advantageously provide an antireflective coating for more exact patterning of the resistor metal layer. Moreover, after formation of the invention's metal resistor, the dielectric cap layer advantageously protects the metal resistor by providing a selective etch stop for a subsequent via etch process.

In contrast to the present invention as defined by amended independent claim 10, Tsunemitsu does not teach, disclose, or suggest "a dielectric cap layer patterned on said metal resistor" and "a second intermetallic dielectric layer formed over said dielectric cap layer and said metal resistor." Tsunemitsu specifically discloses tantalum resistor 16, which is formed on the surface of alumina film 15 and surrounded by tantalum oxide film 17. See, for example, column 3, lines 44-47 and Figure 1 of Tsunemitsu. In Tsunemitsu, tantalum resistor 16 is formed by applying an anodic oxidation process to tantalum film 47. See, for example, Tsunemitsu, column 5, lines 16-32. As a result of the anodic oxidation process, tantalum resistor 16 is formed in a masked portion of tantalum film 47 and the unmasked portion of tantalum film 47 is transformed into a dielectric, i.e. tantalum oxide film 17. See, for example, Tsunemitsu, column 5, lines 16-32.

Thus, in Tsunemitsu, tantalum resistor 16 and the dielectric surrounding tantalum resistor 16, i.e. tantalum oxide film 17, are both formed in the same anodic oxidation

process. Consequently, a dielectric cap layer as required by amended independent claim 10 cannot be patterned on tantalum resistor 16 such that tantalum oxide film 17 is formed over the dielectric cap layer and tantalum resistor 16. Thus, by forming tantalum resistor 16 and tantalum oxide film 17 in the anodic oxidation process, Tsunemitsu teaches away forming a second intermetallic dielectric layer over a dielectric cap layer that is patterned over a metal resistor.

For the foregoing reasons, Applicant respectfully submits that the present invention, as defined by amended independent claim 10, is not suggest, disclosed, or taught by Tsunemitsu. Thus, amended independent claim 10 is patentably distinguishable over Tsunemitsu and, as such, claim 16 depending from amended independent claim 10 is, *a fortiori*, also patentably distinguishable over Tsunemitsu for at least the reasons presented above and also for additional limitations contained in dependent claim 16.

The Examiner has further rejected claims 1 and 3 under 35 USC §103(a) as being unpatentable over Tsunemitsu in view of U.S. patent number 5,120,572 to Nalin Kumar (“Kumar”). For the reasons discussed below, Applicant respectfully submits that the present invention, as defined by amended independent claim 1, is patentably distinguishable over Tsunemitsu, Kumar, or any combination thereof.

The present invention, as defined by amended independent claim 1, also teaches, among other things, “a dielectric cap layer patterned on said metal resistor” and “a second intermetallic dielectric layer formed over said dielectric cap layer and said metal resistor.”

Thus, for similar reasons as discussed above, amended independent claim 1 is also patentably distinguishable over Tsunemitsu.

In contrast to the present invention as defined by amended independent claim 1, Kumar does not teach, disclose, or suggest “a dielectric cap layer patterned on said metal resistor” and “a second intermetallic dielectric layer formed over said dielectric cap layer and said metal resistor.” Kumar specifically discloses electrical connections 92 and 94, which are connected to resistor 48 by via pillars 84. See, for example, column 5, lines 49-51 and Figure 30 of Kumar. However, Kumar fails to teach, disclose, or suggest a dielectric cap layer patterned on a metal resistor and a second intermetallic dielectric layer formed over the dielectric cap layer and the metal resistor.

For the foregoing reasons, Applicant respectfully submits that the present invention, as defined by amended independent claim 1, is not suggest, disclosed, or taught by Tsunemitsu and Kumar, singly, or in combination. Thus, the present invention, as defined by amended independent claim 1, is patentably distinguishable over Tsunemitsu and Kumar and, as such, claim 3 depending from amended independent claim 1 is, *a fortiori*, also patentably distinguishable over Tsunemitsu and Kumar for at least the reasons presented above and also for additional limitations contained in dependent claim 3.

The Examiner has further rejected claim 2 under 35 USC §103(a) as being unpatentable over Tsunemitsu and Kumar in view of U.S. patent number 4,795,921 to Kato et al (“Kato”). As discussed above, amended independent claim 1 is patentably

distinguishable over Tsunemitsu and Kumar and, as such, claim 2 depending from amended independent claim 1 is, *a fortiori*, also patentably distinguishable over Tsunemitsu and Kumar for at least the reasons presented above and also for additional limitations contained in dependent claim 2.

The Examiner has further rejected claims 4 and 5 under 35 USC §103(a) as being unpatentable over Tsunemitsu in view of Kumar. As discussed above, amended independent claim 1 is patentably distinguishable over Tsunemitsu and Kumar and, as such, claims 4 and 5 depending from amended independent claim 1 are, *a fortiori*, also patentably distinguishable over Tsunemitsu and Kumar for at least the reasons presented above and also for additional limitations contained in each dependent claim.

The Examiner has further rejected claims 6 and 7 under 35 USC §103(a) as being unpatentable over Tsunemitsu and Kumar and further in view of U.S. patent number 6,232,194 to Yaung et al. (“Yaung”). As discussed above, amended independent claim 1 is patentably distinguishable over Tsunemitsu and Kumar and, as such, claim 7 depending from amended independent claim 1 is, *a fortiori*, also patentably distinguishable over Tsunemitsu and Kumar for at least the reasons presented above and also for additional limitations contained in dependent claim 7.

The Examiner has further rejected claims 8 and 9 under 35 USC §103(a) as being unpatentable over Tsunemitsu and Kumar and further in view of U.S. patent number 5,525,831 to Ohkawa et al. (“Ohkawa”). As discussed above, amended independent claim 1 is patentably distinguishable over Tsunemitsu and Kumar and, as such, claims 8

and 9 depending from amended independent claim 1 are, *a fortiori*, also patentably distinguishable over Tsunemitsu and Kumar for at least the reasons presented above and also for additional limitations contained in each dependent claim.

The Examiner has further rejected claim 11 under 35 USC §103(a) as being unpatentable over Tsunemitsu in view of Kato. As discussed above, amended independent claim 10 is patentably distinguishable over Tsunemitsu and, as such, claim 11 depending from amended independent claim 10 is, *a fortiori*, also patentably distinguishable over Tsunemitsu for at least the reasons presented above and also for additional limitations contained in dependent claim 11.

The Examiner has further rejected claims 12 and 13 under 35 USC §103(a) as being unpatentable over Tsunemitsu. As discussed above, amended independent claim 10 is patentably distinguishable over Tsunemitsu and, as such, claims 12 and 13 depending from amended independent claim 10 are, *a fortiori*, also patentably distinguishable over Tsunemitsu for at least the reasons presented above and also for additional limitations contained in each dependent claim.

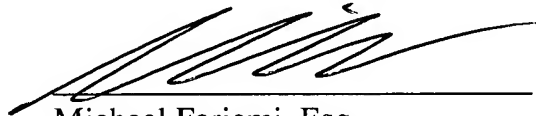
The Examiner has further rejected claims 14 and 15 under 35 USC §103(a) as being unpatentable over Tsunemitsu in view of Yaung. As discussed above, amended independent claim 10 is patentably distinguishable over Tsunemitsu and, as such, claim 15 depending from amended independent claim 10 is, *a fortiori*, also patentably distinguishable over Tsunemitsu for at least the reasons presented above and also for additional limitations contained in dependent claim 15.

The Examiner has further rejected claims 17 and 18 under 35 USC §103(a) as being unpatentable over Tsunemitsu in view of Ohkawa. As discussed above, amended independent claim 10 is patentably distinguishable over Tsunemitsu and, as such, claims 17 and 18 depending from amended independent claim 10 are, *a fortiori*, also patentably distinguishable over Tsunemitsu for at least the reasons presented above and also for additional limitations contained in each dependent claim.

Based on the foregoing reasons, the present invention, as defined by amended independent claims 1 and 10 and claims depending therefrom, is patentably distinguishable over the art cited by the Examiner. Thus, claims 1-5, 7-13, and 15-18 pending in the present application are patentably distinguishable over the art cited by the Examiner. As such, and for all the foregoing reasons, an early allowance of claims 1-5, 7-13, and 15-18 pending in the present application is respectfully requested.

Respectfully Submitted,
FARJAMI & FARJAMI LLP

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Michael Farjami, Esq.
Reg. No. 38, 135

Michael Farjami, Esq.
FARJAMI & FARJAMI LLP
16148 Sand Canyon
Irvine, California 92618
Telephone: (949) 784-4600
Facsimile: (949) 784-4601

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